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Abstract

OPERATIONAL EXPERIENCE FROM THE KJELLER REPROCESSING PILOT PLANT

by

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The Norwegian-Dutch reprocessing pilot plant at Kjeller, Norway, was briefly described at the 2nd Geneva Conference in 1958 (P/585). Since June 1961 the plant has processed irradiated natural uranium fuel from the JEEP reactor at Kjeller.

The following operations are carried out in the plant: Mechanical decanning of the Al-clad fuel elements, dissolving of the decanned uranium metal in nitric acid, and liquid-liquid extraction of the uranium solution to separate uranium, plutonium, and fission products. The extraction is performed in three pulsed columns: the first for extraction of U and Pu and scrubbing of the extracted fission products; the second column for reduction and stripping of Pu and reextraction of the U following the Pu product; the third column for U stripping. The capacity of the extraction columns is about 0.5 kg uranium per hour. Most extraction runs have lasted about 30 hours.

Tributyl phosphate (TBP) diluted with kerosene was used as extractant. The maximum burn-up of the processed fuel was about 400 MWD/ton and the minimum cooling time about 30 days. Various "Purex" type flow-sheets were tested. In particular, the influence of varying feed and scrub acidities in the first column on the decontamination factors for Ru, Zr, and Nb was

studied. Also extractions with varying uranium concentrations in the feed solutions were performed. The use of 20% and 30% TBP as extractant was compared. Two series of test runs were performed for the Eurochemic Company in Mol, Belgium. The purpose of these runs was to evaluate the decontamination factors obtainable with Eurochemic's proposed flow-sheet for the first extraction cycle.
In the first series of test runs, the influence of scrub acidity on fission product removal in the first column was investigated. In the second series, the two first columns were used in a codecontamination cycle to test the Eurochemic "dual acidity scrub" flow-sheet.

In later experiments, ferrous sulphamate was replaced by tetravalent uranium as reductant for plutonium in the partitioning column. In some runs U(IV) was introduced in the top of the second column, in other runs in the middle of the column. Flow-sheets with varying U(IV)/Pu ratios were compared.

The plutonium products resulting from the first cycle experiments was collected and subsequently purified in a second Pu cycle. Various experiments were performed regarding plutonium valency adjustment in the feed solutions. Recently, the influence of various additives in the feed and scrub solutions for the first column to improve fission product decontamination has been investigated. Future plans include studies of alternate extractants and other process variables.